## *REMARKS*

By the forgoing amendment claims 1, 2, 12, 13, 14, 17 and 19 are sought to be amended and claims 21 and 22 are sought to be added.

Claims 1-20 are pending in the application and are presented for reconsideration. The remaining independent claims are claims 1, 12 and 17. Based on the above Amendment and the following Remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections, and withdraw them.

Applicants thank Examiner Sharon for conducting a telephone interview on December 15, 2006. The substance of this interview is reflected in these remarks.

The amendments to the specification and the claims are believed not to introduce new matter, and their entry is respectfully requested. The claims have been amended merely to more clearly define the invention.

The Examiner has rejected claims 1-20 under 35 U.S.C. §101 as being directed to non-statutory subject matter because the claims allegedly do not recite either a tangible or concrete result.

As amended, each of the independent claims recites a step of storing a result in a computer memory. Applicants believe this storing step overcomes the "concrete" basis of this

rejection. In addition, as amended independent claims 1 and 12 recite "optimizing one of a model, structure, shape or design representing an aerodynamic structure or a hydrodynamic structure." The recitation of the representation of an aerodynamic structure or a hydrodynamic structure is also recited in the body of the claim. Similarly, claim 17 recites "optimizing a spline coded structure representing an aerodynamic structure or a hydrodynamic structure." Accordingly, Applicants believe that the pending claims do recite more than merely a mathematical construct and therefore overcomes the "tangible" basis of this rejection. Accordingly, Applicants request that the Examiner reconsider and withdraw this rejection.

The Examiner has rejected claims 1-13 and 15-18 under 35 U.S.C. §102(b) as being anticipated by an article entitled Evolutionary Computation: Comments on the History and Current State, by Bäck, T, et al., IEEE Transactions on Evolutionary Computation, April 1997, Vol. 1, No. 1, pp. 3-17 (hereinafter referred to as "Bäck").

Based on the following Remarks, Applicants respectfully request that the Examiner reconsider these rejections, and withdraw them.

Pending independent claims 1, 12 and 17, as amended, recite:

> 1. A computer based method of optimizing one of a model, structure, shape or design representing an aerodynamic structure or a hydrodynamic structure based on an evolution strategy, comprising:
>
> describing one of the model, structure, shape or design representing an aerodynamic structure or a hydrodynamic structure to be optimized using a parameter set comprising a first number of object parameters;
>
> creating offsprings of the parameter set by modifying the object parameters, wherein said modifying includes at least one of mutating the object parameters and recombining the object parameters;
>
> evaluating quality of the offsprings;

wherein the parameter set comprises at least one strategy parameter representing a step-size of the mutation of associated object parameters;

modifying said first number of the object parameters to a second number of object parameters and modifying a first number of associated strategy parameters to a second number of associated strategy parameters during optimization to optimize one of said model, structure, shape or design; and

storing one of said optimized model, optimized structure, optimized shape or optimized design in a computer storage.

12. A computer based method of optimizing one of a model, structure, shape or design representing an aerodynamic structure or a hydrodynamic structure based on an evolution strategy, comprising:

describing one of the model, structure, shape or design representing an aerodynamic structure or a hydrodynamic structure to be optimized using a parameter set comprising a first number of object parameters;

creating offsprings of the parameter set by modifying the first number of object parameters to a second number of object parameters and modifying a structure of the parameter set, the structure of the parameter set defined by a number and position of the object parameters and strategy parameters; and

evaluating quality of the offsprings;

wherein the parameter set comprises at least one strategy parameter representing a step-size of the mutation of associated object parameters; and

storing one of said optimized model, optimized structure, optimized shape or optimized design in a computer storage.

17. A computer based method for optimizing a spline coded structure representing an aerodynamic structure or a hydrodynamic structure based on an evolution strategy, comprising:

describing the spline coded structure to be optimized using a parameter set comprising a first number of object parameters representing control points and knot points and at least one strategy parameter representing a step-size of a mutation of associated object parameters;

mutating the object parameters and strategy parameters to create offsprings of the set, comprising:

determining a control point insertion,

inserting the control point in the parameter set,

inserting an additional strategy parameter for the inserted control point,

determining the knot points modified by the insertion of the control point,

determining a weighted averaging of strategy parameter values of modified control points, and

assigning the weighted average value as a value of the inserted strategy parameter; ~~and~~

evaluating quality of the offsprings; and

storing the mutated object parameters and strategy parameters in a computer memory.

The invention recited in independent claims 1, 12 and 17 relates to methods for optimization based on an evolution strategy by describing a model, structure, shape or design representing a physical object to be optimized using a parameter set comprising object parameters, creating offsprings of the parameter set by modifying object parameters and/or strategy parameters, and evaluating quality of the offsprings. For example, the method of claim 17 is directed to optimizing a spline coded structure.

In independent claims 1, 12 and 17, the number and/or position of object parameters and/or strategy parameters are changed during the optimization. As recited in claim 1, the number (amount) of object parameters and the number (amount) of associated strategy parameters is changed during the optimization. As recited in claim 12, offsprings of the parameter set are created by modifying or mutating the number of object parameters as well as the structure of the parameter set, wherein the structure of the parameter set is defined by the number and position of the object parameters and strategy parameters. As recited in claim 17, offsprings of the parameter set are created by inserting a control point and inserting an additional strategy parameter in the parameter set.

In contrast Bäck teaches that the number of strategy parameters, for example, is kept constant and therefore teaches away from the present invention. This is shown on page 7, column 1, line 8 of Bäck which defines the number of strategy parameters as being equal to "n." These "n" number of strategy parameters are then mutated by adding a standard deviation as

shown in Figure 6. Applicants note that this mutation changes the values of the strategy parameters but does not change the amount or number of strategy parameters, i.e., there are still "n" strategy parameters. This is also clearly stated beginning at the last paragraph on page 7, column 1 where Bäck states that "This mutation scheme....is schematically depicted (for n = 2) in the middle of Fig. 2. .....In the case considered here, i.e., up to *n* variances..." (emphasis added). This paragraph teaches that the number of parameters is set to "n" (in this example n = 2) and then they are mutated such that there are up to n variances. That is, the number of strategy parameter variances can not exceed "n" which teaches away from the claimed invention where the number (amount) of strategy parameters and/or object parameters is modified.

Claims 2-11 depend from claim 1 and thereby incorporate all the limitations of claim 1. Therefore, all arguments advanced above with respect to claim 1 are hereby incorporated so as to apply to claims 2-11.

Claims 13 and 15-16 depend from claim 12 and thereby incorporate all the limitations of claim 12. Therefore, all arguments advanced above with respect to claim 12 are hereby incorporated so as to apply to claims 13 and 15-16.

Claim 18 depends from claim 17 and thereby incorporates all the limitations of claim 17. Therefore, all arguments advanced above with respect to claim 17 are hereby incorporated so as to apply to claim 18.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw all pending objections and 102 rejections.

The Examiner has rejected claims 14 and 19 under 35 U.S.C. §103(a) as allegedly being unpatentable over Bäck in view of Weinert, K, et al., Discrete NURBS-Surface Approximation Using an Evolutionary Strategy, REIHE CI 87/00, SFB 531, 2000, pp. 1-7 (hereinafter referred to as "Weinert").

The Examiner has rejected claim 20 under 35 U.S.C. §103(a) as being unpatentable over Bäck in view of Official Notice.

Claim 14 depends from claim 12 and thereby incorporates all the limitations of claim 12. Therefore, all arguments advanced above with respect to claim 12 are hereby incorporated so as to apply to claim 14. Weinert does not teach or suggest (and the Examiner does not even contend that Weinert teaches or suggests) the feature of modifying the number of strategy or object parameters. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

Claims 19 and 20, as amended, depend from claim 1 and thereby incorporate all the limitations of claim 1. Therefore, all arguments advanced above with respect to claim 1 are hereby incorporated so as to apply to claims 19 and 20. Weinert does not teach or suggest (and the Examiner does not even contend that Weinert teaches or suggests) the feature of modifying

the number of strategy or object parameters. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

Therefore, Applicants believe that the rejection of claims 14, 19 and 20 has been overcome and respectfully request that the Examiner reconsider and withdraw the rejection of claims 14, 19, and 20.

***Conclusion***

Applicants believe that all of the stated grounds of objection and rejection set forth by the Examiner in the Office Action have been properly accommodated or addressed. Applicants, therefore, respectfully request that the Examiner reconsider all presently outstanding objections and rejections and withdraw them. The Examiner is invited to telephone the undersigned representative if it is felt that an interview might be useful for any reason.

Respectfully submitted
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Date: 16 December 2006

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